

## PATENT SPECIFICATION (11)

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(19)



(54) A PROCESS FOR THE ELIMINATION OF AMMONIA PRESENT  
 IN COKE-OVEN GASES

(71) We, GÜNTER WUNDERLICH, of German Nationality, of Bottrop, Steedrader Strasse 37, Germany, and HEINRICH WISSE, of German Nationality, of Recklinghausen, Lemmstr. 2, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to the treatment of coke-oven gases.

It has been proposed to clean the gases produced from coke ovens, for example, by washing them with water so as to remove noxious gases such as ammonia and hydrogen sulphide. The liquor resulting from this washing is too noxious for disposal without treatment and one treatment is to drive the gases from the liquor so that it can be used again for washing the coke oven gases. The gases desorbed from the liquor are sometimes referred to as deacidification vapours or gases and contain the ammonia and hydrogen sulphide from the coke oven gases but in higher concentrations.

In order to dispose of the deacidification gases it has been proposed to burn them with an amount of air sufficient for conversion of the ammonia in the gases into nitrogen and water and the hydrogen sulphide in the gases into sulphur, the heat of the ammonia combustion being recovered in the form of high-pressure steam and the combustion gases being worked up to sulphur in known manner.

Generally, only one combustion furnace is required for this known process, but problems arise in controlling the combustion so that both the ammonia and the hydrogen sulphide are oxidized to the required extent. Too little air will result in the incomplete decomposition of the ammonia and too much air the oxidation of the sulphur to sulphur dioxide.

It is an object of the invention to overcome the above difficulty.

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By the present invention there is provided a process for the complete elimination by burning to form nitrogen and water of the total amount of free ammonia present in coke oven-gases, the ammonia having been washed out with water and concentrated in deacidification gases desorbed from the liquor resulting from washing the coke-oven gases, in which the deacidification gases are separated into ammonia gas largely free from hydrogen sulphide and hydrogen sulphide gas largely free from ammonia, and the gases are burnt separately the ammonia burning completely to form nitrogen and water, the heat of the ammonia being recovered in the form of high pressure steam, and the hydrogen sulphide being only partially burnt so as to produce sulphur dioxide which with the remaining hydrogen sulphide is used to produce sulphur.

In the burning of ammonia present in coke-oven gases with simultaneous burning of hydrogen sulphide to form sulphur, it has been found that it can be advantageous to separate the total amount of the deacidification gases into ammonia gas which is largely free from hydrogen sulphide and hydrogen sulphide gas which is largely free from ammonia and to burn them separately.

In contrast to the known process, at least two combustion furnaces must be installed to carry out the process. It has the advantage, however, that less condensate that can contain sulphur or sulphur dioxide has to be drawn off in the course of working up the hydrogen sulphide.

Separation of the deacidification gases into ammonia gas largely free from hydrogen sulphide and hydrogen sulphide gas largely free from ammonia can be effected in a separation column specifically for that purpose or in the upper part of the desorption column by means of which the deacidification gases are obtained from the liquor. In the latter case, the height of the column is increased by a number of plates and the column is operated with the appropriate

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amount of reflux. Ignition of fuel gases can be added to the ammonia and hydrogen sulphide gases to facilitate combustion.

5 The gases from the ammonia combustion can be released into the atmosphere after being cooled in a waste heat boiler.

10 However, if required, and after the condensates have been drawn off, a part or the whole amount of the ammonia combustion gases can be added to partially burnt hydrogen sulphide gas prior to treatment by the Claus process in order to establish advantageous temperatures and concentrations of hydrogen sulphide and sulphur dioxide.

15 120 m<sup>3</sup> ammoniacal liquor having a temperature of 95°C and virtually free from hydrogen sulphide leave the base of a deacidifier of an ammonia-hydrogen sulphide circulation scrubber of a coke-oven plant producing 75,000 m<sup>3</sup> (N.T.P.) gas per hour.

20 The ammoniacal liquor in an amount corresponding to a continuous production of 490 kg/hr of ammonia, that is to say, 35 m<sup>3</sup> per hour, is conducted to a still, at the base of which steam is injected at a rate such that 25 of which steam is injected at a rate such that the waste water obtained contains less than 0.1 gram per litre of free ammonia.

30 The gas leaving the head of the column at a rate of 3,290 kg per hour contains almost the total amount of ammonia obtained, that is to say, 490 kg per hour. The gas is burnt in a known waste heat boiler, in which operation 3.0 t/hr of saturated steam at a pressure of 40 atmospheres are 35 obtained. 550 Cubic metres (N.T.P.) of gas containing 50% by volume of hydrogen sulphide are obtained hourly at the head of the deacidifier, which is worked up by partial burning in a known manner in the 40 Claus process to produce solid sulphur at a rate of 380 kg per hour.

45 Attention is drawn to co-pending Patent Application No. 24646/70 (Serial No. 1,318,393) which includes claims which may be infringed by a performance of the invention of the present application.

#### WHAT WE CLAIM IS:—

1. A process for the complete elimination

of ammonia present in coke-oven gases to form nitrogen and water, the ammonia having been washed out with water and concentrated in deacidification gases desorbed from the liquor resulting from washing the coke-oven gases, in which the deacidification gases are separated into ammonia gas largely free from hydrogen sulphide and hydrogen sulphide gas largely free from ammonia, and the gases are burnt separately, the ammonia burning completely to form nitrogen and water, the heat of the ammonia being recovered in the form of high pressure steam, and the hydrogen sulphide being only partially burnt so as to produce sulphur dioxide which with the remaining hydrogen sulphide is used to produce sulphur.

2. A process as claimed in claim 1, wherein separation of the ammonia gas from the deacidification gases is effected in a separating column to which the deacidification gases are fed or in the upper part of the column in which the deacidification gases are desorbed from the liquor resulting from washing the coke-oven gases.

3. A process as claimed in claim 1 or 2, wherein fuel gases are added to the ammonia gas and/or the hydrogen sulphide gas prior to combustion.

4. A process as claimed in claim 1, 2 or 3, wherein the gases from the ammonia combustion are cooled in a waste heat boiler, freed from condensate and then added, either the whole amount or part thereof, to partially burnt hydrogen sulphide gas and subjected to treatment in the Claus process to produce sulphur.

5. A process as claimed in any one of claims 1 to 4 carried out substantially as hereinbefore described.

6. Sulphur produced by a process as claimed in any one of the preceding claims.

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